



PRELIMINARY
SPECIFICATIONS

semiconductor products

Minneapolis-Honeywell Regulator Company
MINNEAPOLIS 8, MINNESOTA

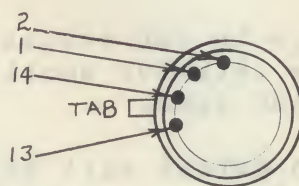
ES1001
ES1004
INTEGRATED
DECADE
RING COUNTER

GENERAL DESCRIPTION

A fully integrated, single-chip silicon decade ring counter having ten output terminals, a single-phase clock input, a clearing input and two supply terminals, packaged in a 14-pin, low-silhouette TO-5. In operation, a positive potential appears at any one output, and is made to progress to successive outputs by applying positive going pulses to the clock input. A positive pulse applied to the clearing input leaves all outputs in the "OFF" (at ground potential) condition. Counters may be direct-coupled to form decimal divider chains.

SPECIFICATIONS

Supply Voltage	ES1001	7.5 to 9.0V.
	ES1004	9.0 to 12V.
Operating Temperature		0 to 55°C.
Speed (clock rate)		200 kc, min.
Input: Pulse Amplitude		2.0V min.
Impedance (2V input)		25 kohm min.
Output: Open Circuit Voltage		2.0V min.
Load Resistance		25 kohm min.
Clearing Signal		1.0V min.
Package	14 pin, low-silhouette TO-5	
Pin Connections		
1 through 10		Output
11		Supply Positive
12		Clock Input
13		Supply Negative
14		Clear Input



CIRCUIT DESCRIPTION

Each of the ten stages of the ring consists of two silicon controlled rectifiers, SCR's, used to store the counting "bit," and two PNP transistors used as coupling devices (see Figure 1). Both cathode and anode-gates of the SCR's are shown. The anode-gates are used as output terminals, rather than as trigger points.

The cathodes of the input SCR's, at left in Figure 1, are common and are connected to the collector of the "keying" transistor. The "keying" transistor receives the clock pulses.

The output SCR's, at right of Figure 1, are also common and their cathodes are connected to the voltage divider formed by R_1 and R_2 .

The input and output half-stages make up a quasi-two-phase system, in which the "ON" condition is commutated between adjacent outputs in two distinct steps.

OPERATION

Refer to Figure 1, with conditions that the clock and clear signals are "OFF", the $Y(n-1)$ output SCR of stage $(n-1)$ is conducting, and all other SCR's are "OFF".

The voltage between anode and anode-gate of $Y(n-1)$ causes transistor $W(n-1)$ to conduct. The transistor will saturate and produce a voltage at output $(n-1)$. This voltage will be larger than the node A voltage by an amount equal to the drop across the SCR (about 1 volt). The remaining outputs are held at ground by resistors R_4 .

The $X(n)$ input SCR of stage (n) cannot fire until a positive clock pulse appears and Q_2 conducts. With a clock pulse applied, $X(n)$ fires, and the voltage drops across Q_2 and $X(n)$. The current through $Y(n-1)$ falls, and if the node A voltage is sufficiently high, it will turn "OFF". The $Y(n)$ output SCR of stage (n) cannot turn "ON", as the high voltage at node A will reverse bias the cathode-gate junction. $X(n)$ and its transistor, $V(n)$, will be strongly saturated.

As the clock pulse falls, Q_2 turns "OFF" and the gate voltage of $Y(n)$ increased. $Y(n)$ fires when this voltage sufficiently exceeds the voltage at node A. A positive voltage appears at output (n) , and commutation is complete.

Because commutation takes place in two stages, the output pulse has two steps (see Figure 2). The relative amplitude of the steps depends on the supply voltage and output load.

A positive pulse applied at an output will have no effect except when Q_2 is conducting. A "bit" is stored at the output by applying a positive voltage at the preceeding output and at the clock input.

To clear the counter a positive pulse is applied to Q_3 . The voltage at node B falls, and all SCR's turn "OFF".

H O N E Y W E L L

I N C.

Dear Sir:

Thank you for your request for information on the Honeywell Decade Ring Counter.

The announcement by Honeywell of the development of a circuit containing 20 SCR's, 23 PNP and NPN transistors plus associated passive components in integrated form, on a single chip, has created widespread interest and acclaim.

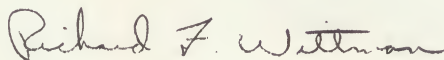
The attached data sheet contains, in addition to performance specifications, a complete description of the circuit and its operation.

The Honeywell Decade Ring Counter is available now in two voltage ranges in quantities adequate for evaluation or prototype work. The unit price in sample quantities is \$150.00.

Due to the high rate of interest in the Decade Ring Counter, we are accelerating our preproduction schedule so that in the near future we will be in a position to supply production quantities of this unique integrated circuit.

Again, thank you for your interest in our microelectronic products. If you desire further information please get in touch with me.

Very truly yours,



Richard F. Wittman
Product Marketing Manager

RFW:la

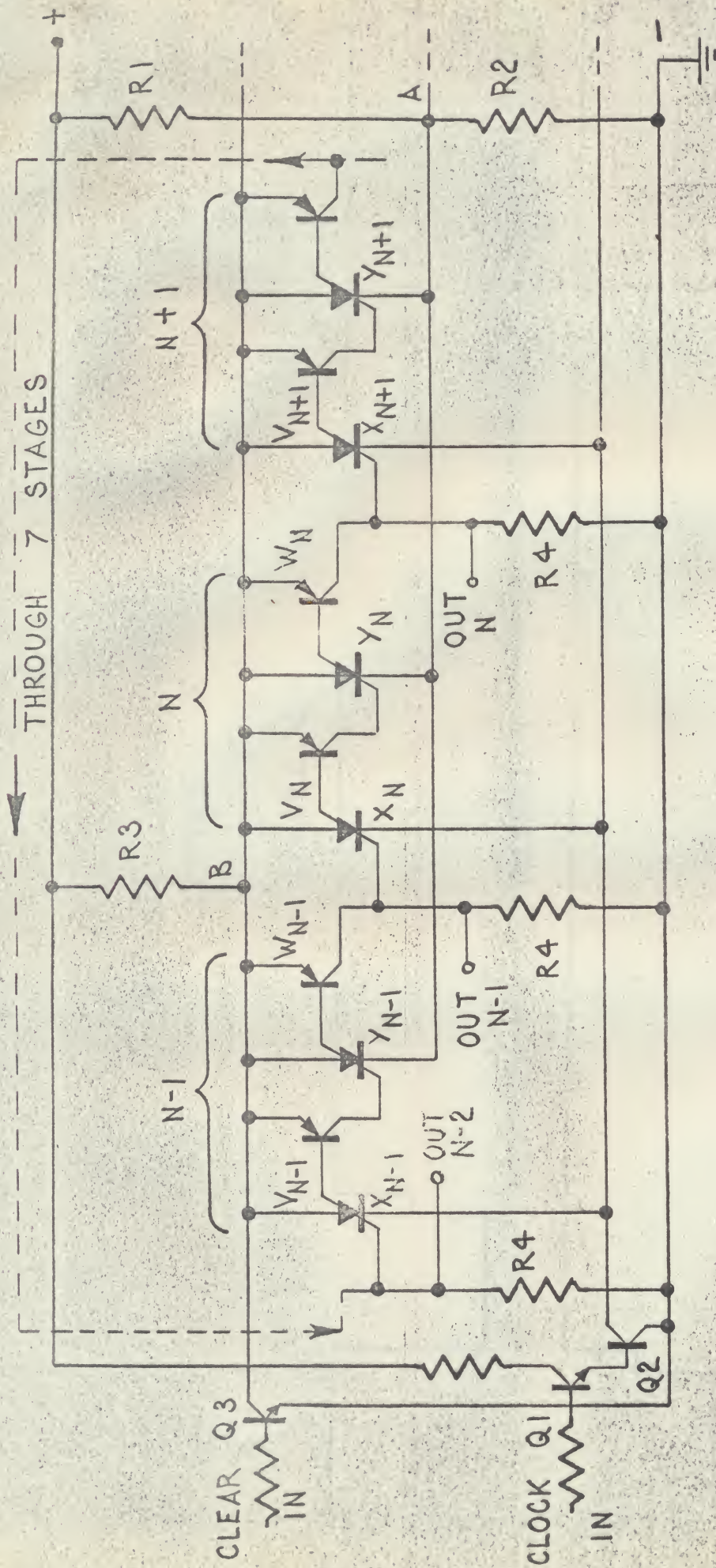
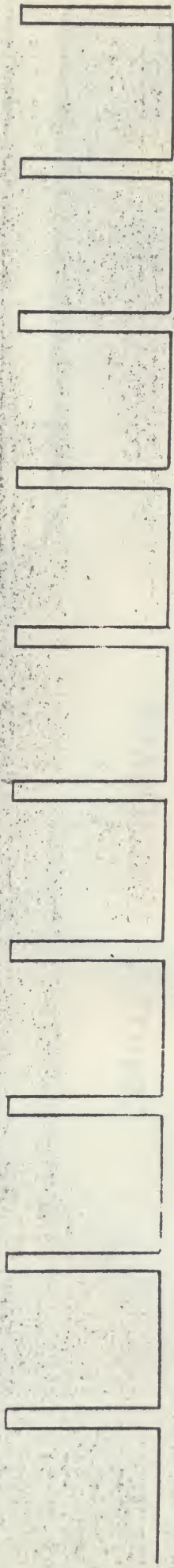


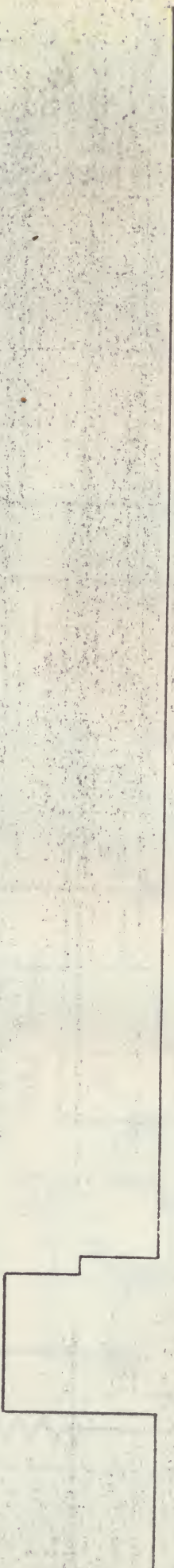
FIGURE 1
COUNTER SCHEMATIC



CLOCK



OUTPUT 1



OUTPUT 2

FIGURE 2
OUTPUT WAVEFORM